

# Epithelium

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*This article discusses the epithelium, an animal anatomical structure. For the fungal anatomical structure of the same name, see Pileipellis.*

In dermatology **epithelium** is a tissue composed of a layer of cells. In humans, it is one of four primary body tissues. Epithelium lines both the outside (skin) and the inside cavities and lumen of bodies. The outermost layer of our skin is composed of dead stratified squamous epithelial cells, as are the mucous membranes lining the inside of mouths and body cavities. Other epithelial cells line the insides of the lungs, the gastrointestinal tract, the reproductive and urinary tracts, and make up the exocrine and endocrine glands.

Functions of epithelial cells include secretion, absorption, protection, transcellular transport, sensation detection, and selective permeability. Endothelium (the inner lining of blood vessels) is not related to epithelium except by name.

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## Classification

Epithelial cells are classified by the following three factors:

- Shape
- Stratification (number of layers)
- Specialization

### Shape

- **Squamous:** Squamous cells are flat cells with an irregular flattened shape. The one-cell layer of simple squamous epithelium that forms the alveoli of the respiratory membrane, and the endothelium of capillaries, and is a minimal barrier to diffusion. Places where squamous cells can be found include the alveoli of the lungs, the filtration tubules of the kidneys, and the major cavities of the body. These cells are relatively inactive metabolically, and are associated with the diffusion of water, electrolytes, and other substances.
- **Cuboidal:** As the name suggests, these cells have a shape similar to a cube, meaning its width is the same size as its height. The nuclei of these cells are usually located in the center.
- **Columnar:** These cells are taller than they are wide. Simple columnar epithelium is made up of a single layer of cells that are longer than they are wide. The nucleus is also closer to the base of the cell. The small intestine is a tubular organ lined with this type of tissue. Unicellular glands called goblet cells are scattered throughout the simple columnar epithelial cells and secrete mucus. The free surface of the columnar cell has tiny hairlike projections called microvilli. They increase the surface area for absorption.

- **Transitional:** This is a specialized type of epithelium found lining organs that can stretch, such as the urothelium that lines the bladder and ureter of mammals. Since the cells can slide over each other, the appearance of this epithelium depends on whether the organ is distended or contracted: if distended, it appears as if there are only a few layers; when contracted, it appears as if there are several layers.

## Stratification

- **Simple:** There is a single layer of cells.
- **Stratified:** More than one layer of cells. The superficial layer is used to classify the layer. Only one layer touches the basal lamina. Stratified cells can usually withstand large amounts of stress.
- **Pseudostratified with cilia:** This is used mainly in one type of classification (pseudostratified columnar epithelium). There is only a single layer of cells, but the position of the nuclei gives the impression that it is stratified. If a specimen looks stratified, but you can identify cilia, the specimen is pseudostratified ciliated epithelium since stratified epithelium cannot have cilia.

## Specializations

- **Keratinized** cells contain keratin (a cytoskeletal protein). While keratinized epithelium occurs mainly in the skin, it is also found in the mouth and nose, providing a tough, impermeable barrier.
- **Ciliated** cells have apical plasma membrane extensions composed of microtubules capable of beating rhythmically to move mucus or other substances through a duct. Cilia are common in the respiratory system and the lining of the oviduct.

## Examples

- **Squamous**
  - **Simple squamous:** Found in blood vessels & lymph channels (called endothelium) and body cavities (called mesothelium)
  - **Keratinized stratified squamous:** Found in human skin (specifically, the dead superficial layer); also found in masticatory oral mucosa (attached gingiva, dorsum of tongue, hard palate, etc.)
  - **Non-Keratinised stratified squamous:** Found in human oesophagus (Oral Mucosa) specifically non-masticatory "movable" mucosa, and vagina
- **Cuboidal**
  - **Simple cuboidal:** Found in thyroid follicles
  - **Stratified cuboidal:** Exclusively found in sweat gland ducts
- **Columnar**
  - **Ciliated simple columnar:** Found in intestine and kidney (specifically, proximal convoluted tubule)
  - **Stratified columnar:** Ducts of submandibular glands
- **Transitional:** Specialized #REDIRECT [[#REDIRECT [[

## Junctional complexes

A cell junction is a structure within a tissue of a multicellular organism. Cell junctions are especially abundant in epithelial tissues. They consist of protein complexes and provide contact between neighbouring cells, between a cell and the extracellular matrix, or they built up the paracellular barrier of epithelia and control the paracellular transport.

## Secretory epithelia

As stated above, secretion is one major function of epithelial cells. Glands are formed from the invagination / infolding of epithelial cells and subsequent growth in the underlying connective tissue. There are two major classification of glands: endocrine glands and exocrine glands.

## Embryology

There are epithelial tissues deriving from all of the embryological germ layers:

- from ectoderm (e.g., the epidermis);
- from endoderm (e.g., the lining of the gastrointestinal tract);
- from mesoderm (e.g., the inner linings of body cavities).

## See also

- Squamous cell
- Columnar epithelia
- Cuboidal epithelia
- Transitional epithelia
- Corneal epithelium

## References

- Molecular Biology of the CELL, 4th edition, Alberts et al., 2002

### Biological tissue

Animals : Epithelium - Connective - Muscular - Nervous

Plants : Dermal - Vascular - Ground

### Epithelial tissue

squamous (simple, stratified, cell), columnar (simple, stratified), cuboidal (simple, stratified), transitional, pseudostratified/respiratory

cilium, microvilli, stereocilia, cell junction, basal lamina

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